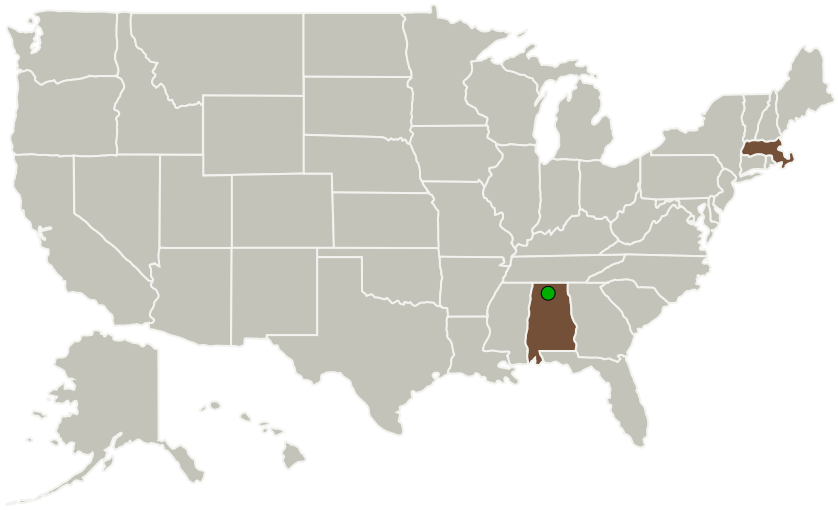
Polybenzoxazine Manufacturing Technology for Lightweight Large Scale Structures, Phase I

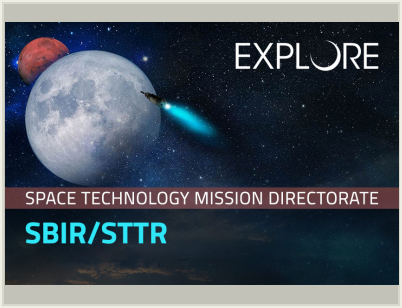
Completed Technology Project (2012 - 2012)

Project Introduction

The proposed work will demonstrate the process feasibility and mechanical properties of a polybenzoxazine/carbon fiber composite that will meet NASA's requirements for large scale lightweight structures with high temperature performance. Our proposed approach utilizes a benzoxazine resin formulation including a small main-chain oligomer in combination with a high performance monomer. This novel approach will provide for low resin viscosity to allow easier infiltration of the resin mixture into fibrous reinforcements, while maintaining superior mechanical properties, particularly temperature resistance. This technology will allow utilization of well-known manufacturing techniques capable of preparing large scale structures having affordable, reliable, predictable performance with reduced costs. The processing characteristics will be targeted to molding methods including resin transfer molding, vacuum assisted resin transfer molding, autoclave molding, and similar methods. To achieve these processability improvements we propose using a benzoxazine resin mixture of small main-chain oligomers based on bisphenol-F isomers and oxydianiline in combination with a high performance monomer. The high performance monomer is specifically designed to enhance the rate of polymerization through the near-neighbor approach. The polybenzoxazine matrix will be reinforced with carbon fibers. This work will extend previously demonstrated lightweight polybenzoxazine polymer achievements by utilizing enhanced modern chemistry to extend the processing window. The result will be a superior lightweight material with superior processability compared to other polymer matrix composites.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Material Answers LLC	Lead Organization	Industry	Weston, Massachusetts
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Massachusetts

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138413)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Material Answers LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Chris Scott

Co-Investigator:

Chris Scott

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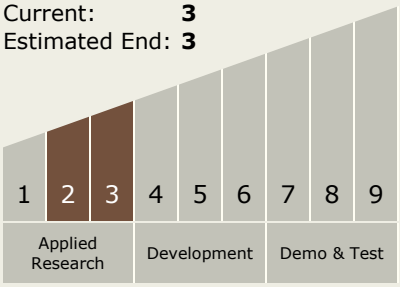
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System